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THE WORK OF THE SCOTTSBLUFF RECLAMATION PROJECT EXPERIMENT FARM IN 1916.[1]

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INTRODUCTION.

In this circular are reported the results secured with crops under irrigation on the Scottsbluff Experiment Farm. The results of the dry-land cropping work in cooperation with the Office of Dry-Land Agriculture are to be published elsewhere. In this report no attempt has been made to go into the details of the work, but rather to summarize the results obtained, including the results of previous years, where such work has been conducted for several years.

The arrangement of the fields and the location of the experiments in 1916 are shown in figure 1.

CONDITIONS ON THE PROJECT.

WEATHER CONDITIONS.

The weather conditions during the growing season of 1916 were very similar to those of the previous two years. The seasonal precipitation was somewhat below the average, whereas the temperature during the same period was in the extreme both ways. The highest windstorms of the season occurred on May 7, May 9, and June 21. The highest velocity attained by the storm of May 7 was 48 miles an

[1] The Scottsbluff Experiment Farm is located on the North Platte Reclamation Project, 6 miles east of Mitchell and about 8 miles northwest of Scottsbluff, Nebr. The farm includes 160 acres of land, and the work is supported cooperatively by the United States Department of Agriculture and the Nebraska Agricultural Experiment Station. Operations on this farm were begun in 1909.

[2] Mr. Knorr resigned from the service on January 15, 1917, and has been succeeded by Mr. James A. Holden.

hour. During the second and third storms it reached only 36 miles per hour, but as the wind on June 21 was very warm—almost hot—the damage to growing crops was serious.

A hail that fell on the night of June 1 damaged the grain and other crops to some extent. A second hailstorm on June 12 practically destroyed or cut off to the ground all crops growing on the farm.

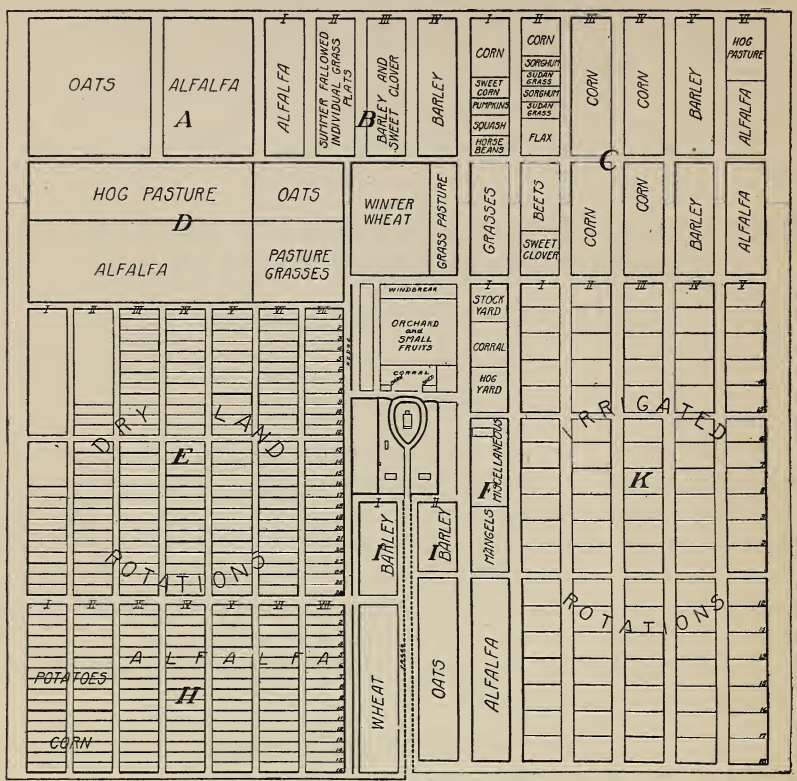

FIG. 1.—Diagram of the Scottsbluff Experiment Farm, showing the arrangement of the fields and location of the experiments in 1916.

The abnormally high temperature during the remainder of the growing season did much to bring about a rapid recovery of the crops, and fair yields were secured. The hailstorms in both cases were entirely local, the area affected by them being about 9 square miles. The climatic observations at the experiment farm, which are made in cooperation with the Office of Biophysical Investigations of the Bureau of Plant Industry, are summarized in Table I.

TABLE I.—*Summary of climatological observations at the Scottsbluff Experiment Farm, 1911 to 1916, inclusive.*

PRECIPITATION (INCHES).

Year, etc.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1911	0.45	0.10	0	2.31	0.81	2.13	1.28	0.65	2.14	1.10	0.08	0.34	11.39
1912	.20	.60	.27	3.72	1.65	1.61	2.45	2.77	2.70	1.16	.37	0	18.51
1913	0	0	0	.13	3.70	1.71	1.30	4.33	1.18	.47	.11	.80	13.73
1914	0	.04	0	3.18	2.29	1.84	.39	.24	.24	.88	0	.36	9.76
1915	.15	.71	2.12	4.27	2.37	1.94	2.20	4.62	3.65	.90	.05	.60	23.58
1916	.19	.16	.09	.53	2.21	2.14	1.87	2.24	.48	1.00	.19	.27	11.37
Average	16	.27	.41	2.36	2.17	1.89	1.58	2.52	1.73	.92	.13	.39	14.72

EVAPORATION (INCHES).

1911	.....	.....	.....	5.54	7.15	8.90	9.08	7.43	6.18	.....	.....	.....	44.28
1912	.....	.....	.....	4.24	7.14	6.64	6.67	6.32	4.16	.....	.....	.....	35.17
1913	.....	.....	.....	5.76	6.32	6.80	6.93	6.64	4.69	.....	.....	.....	37.14
1914	.....	.....	.....	4.60	6.42	7.17	8.42	7.91	5.77	.....	.....	.....	40.40
1915	.....	.....	.....	4.85	5.27	6.14	6.75	5.73	4.74	.....	.....	.....	33.48
1916	.....	.....	.....	4.86	6.72	7.13	8.91	6.70	5.96	.....	.....	.....	40.28
Average	.....	.....	.....	4.98	6.54	7.13	7.80	6.79	5.25	.....	.....	.....	38.46

DAILY WIND VELOCITY (MILES PER HOUR).

Mean:													
1911	6.1	6.4	7.8	8 4	8.8	6.0	5.2	5.4	5.4	5.9	6.8	5.9	.....
1912	5.4	5.7	6.7	8.6	8.1	5.4	4.0	4.2	5.0	5.0	4.3	6.4	.....
1913	7.0	4.7	5.8	7.2	7.7	6.1	4.1	3.3	3.8	5.1	3.6	4.5	.....
1914	5.6	5.6	7.3	7.4	6.2	5.2	4.3	4.7	4.8	4.0	3.7	5.1	.....
1915	5.3	5.1	5.4	6.4	6.1	6.5	4.4	3.1	4.0	3.9	5.6	4.2	.....
1916	.....	.....	.....	5.8	7.0	5.6	4.0	2.9	3.5	4.1	4.6	5.5	.....
Maximum:													
1911	15.9	13.7	15.8	14.6	15.2	10.8	8.4	9.2	11.1	12.2	15.6	8.4	.....
1912	12.4	14.7	15.3	31.4	16.6	15.9	6.0	7.0	11.5	10.8	12.6	15.8	.....
1913	22.9	8.3	15.7	18.3	14.9	16.7	9.1	6.9	8.0	15.9	8.2	11.7	.....
1914	10.8	13.8	13.7	13.3	13.8	12.1	6.7	9.2	8.3	11.2	10.0	16.7	.....
1915	12.7	19.9	13.9	16.0	16.4	13.3	7.8	6.0	8.3	8.8	13.1	8.2	.....
1916	.....	.....	.....	11.9	13.3	10.8	7.2	7.1	7.1	7.6	10.9	12.9	.....
Minimum:													
1911	1.7	2.1	3.0	3.6	4.8	3.0	3.1	2.6	2.9	2.5	1.9	1.2	.....
1912	1.6	1.4	2.7	3.2	2.9	1.6	2.0	2.6	2.4	2.0	1.1	1.3	.....
1913	1.9	1.0	1.5	2.5	3.7	.1	.4	.2	.1	.8	1.1	.8	.....
1914	2.1	1.3	1.9	2.9	2.9	2.1	1.3	2.5	1.7	1.9	.5	.3	.....
1915	.8	.4	.5	2.4	.1	2.7	1.7	.9	.9	1.5	1.3	1.3	.....
1916	.....	.....	.....	2.1	3.5	2.9	1.9	1.3	1.5	2.1	.9	1.7	.....

MONTHLY TEMPERATURE (°F.).

Mean:													
1911	29	27	42	45	46	70	69	68	64	43	32	24	.....
1912	20	24	21	45	55	63	69	67	52	47	39	27	.....
1913	22	15	31	46	57	64	69	72	56	56	39	14	.....
1914	31	22	37	45	57	66	74	69	62	43	40	21	.....
1915	22	30	27	52	51	60	67	66	58	50	38	31	.....
1916	17	30	43	45	55	63	75	68	59	45	31	20	.....
Maximum:													
1911	68	64	74	80	88	95	94	98	93	78	66	62	.....
1912	53	50	55	73	87	93	91	96	89	83	71	56	.....
1913	[a]58	61	67	84	90	95	97	97	90	83	73	36	.....
1914	50	62	66	77	87	95	98	98	92	81	75	50	.....
1915	63	67	63	79	89	82	93	91	92	83	72	63	.....
1916	63	66	78	82	92	99	98	92	94	80	74	60	.....
Minimum:													
1911	−19	− 7	11	11	22	42	40	41	38	11	−12	−11	.....
1912	−21	−14	−15	25	30	39	47	44	22	12	3	1	.....
1913	−28	−18	−11	16	26	41	37	50	24	12	13	− 9	.....
1914	8	−23	7	10	31	42	51	45	30	20	3	−15	.....
1915	−23	− 4	− 8	28	23	32	41	44	36	21	6	− 5	.....
1916	−22	−15	− 9	19	24	35	50	42	29	17	−21	−17	.....

[a] 11 days.

TABLE I.—*Summary of climatological observations at the Scottsbluff Experiment Farm, 1911 to 1916, inclusive*—Continued.

KILLING FROSTS.

Year.	Last in spring.		First in autumn.		Length of frost-free period.
	Date.	Minimum temperature.	Date.	Minimum temperature.	
		°F.		°F.	
1911	May 26	28	Oct. 3	31	129
1912	May 13	30	Sept. 16	31	124
1913	May 2	26	Sept. 19	31	124
1914	May 7	32	Sept. 13	30	129
1915	June 12	32	Oct. 3	32	113
1916	May 15	29	Sept. 14	30	122

CROP CONDITIONS.

During the year, 94 additional farm units on the reclamation project were taken up, making 1,189 farms with a total of 95,290 acres irrigable, of which 75,620 acres were actually irrigated. The average yields per acre, with one or two exceptions, were rather lower than those of the previous year, but the prices were higher, so that the average farm value per acre of the crops was estimated at $21.85, or $3.30 above that of the previous year, which was in turn $3.30 above that of 1915.

The acreage, yields, and farm values of the crops produced in 1916 are shown in Table II, the figures being furnished by the United States Reclamation Service. The total cropped acreage, as shown in the table, is less than the total irrigated acreage specified in the preceding paragraph, because of the fact that 854 acres of land were sown to alfalfa without a nurse crop, and though listed as irrigated land, gave no crop return. In addition to this, it is reported that 4,937 acres were seeded to alfalfa with a nurse crop, making a total of 5,791 acres of alfalfa seeded in 1916, or about 18 per cent of the normal alfalfa acreage of the project.

In 1915 the total area on the project seeded to alfalfa was 6,686 acres, though the actual net increase in alfalfa-producing area in 1916 was only 1,538 acres, showing that something over 5,000 acres of alfalfa land was plowed up to use for other crops, though some of the acreage may have reverted from the loss of stand in new seeding. It may also be remarked that in 1916 a much smaller proportion of the alfalfa was seeded without a nurse crop. In 1915 nearly 30 per cent of the new seeding was put in without a nurse crop, while in 1916 only about 15 per cent was seeded in this manner.

The most noticeable increases in crop acreages for 1916 were in oats (3,000 acres), barley (2,500 acres), sugar beets (1,200 acres),

and wheat (750 acres). The most conspicuous decrease in crop acreage was in the case of corn, of which there was nearly 3,000 acres less than in 1915.

TABLE II.—*Acreage, yields, and farm values of crops produced on the North Platte Reclamation Project in 1916.*

Crop.	Area.	Unit of yield.	Yields.			Farm values.		
			Total.	Average.	Maximum.	Per unit of yield.	Total.	Average per acre.
	Acres.							
Alfalfa hay	32,601	Ton	59,706	1.8	4.0	$7.50	$447,795	$13.74
Alfalfa seed	859	Bushel	797	.9	2.2	9.00	7,717	8.35
Oats	10,375	do	191,204	18.4	60.5	.50	95,602	9.21
Beets, sugar	9,024	Ton	92,104	10.2	20.0	6.25	575,650	63.79
Corn	6,715	Bushel	125,911	18.8	45.0	.70	88,138	13.12
Barley	4,857	do	106,096	21.8	80.0	.60	63,658	13.10
Pasture	3,871					10.00	38,710	10.00
Wheat	2,617	Bushel	28,207	10.8	60.0	1.20	33,848	12.93
Potatoes	1,735	do	274,100	158.0	368.0	.90	246,690	142.18
Hay other than alfalfa	746	Ton	656	.9	2.0	8.00	5,248	7.03
Millet seed	238	Bushel	2,305	9.7	24.0	1.00	2,305	9.68
Beans	229	do	2,268	9.9	33.3	6.00	13,608	59.42
Rye	158	do	1,012	6.4	20.0	.90	910	5.77
Cane for hay	142	Ton	646	4.5	3.0	2.00	1,292	9.09
Garden	120						6,521	54.34
Beets, stock	79	Ton	1,112	14.1	25.0	3.00	3,336	42.23
Corn fodder	69	do	291	4.2	10.0	1.30	378	5.48
Miscellaneous	331						2.527	7.63
Total	74,766						1,633,389	
Value per acre								21.85

LIVE STOCK.

The live-stock industries on the project have continued to develop, though not so rapidly as in former years. The number of live stock is now approximately sufficient to consume all of the hay and other forage, and it was even necessary last year to ship in some hay to meet the local demands. The inventory of live stock on the project farms is shown in Table III, which is based on data collected by the United States Reclamation Service. This inventory includes only the live stock owned on project farms and does not cover the stock brought in from the range for winter feeding or to be fattened for market.

Of the stock brought in to be wintered or fattened, there were 83,500 head of sheep, 4,600 head of cattle, and 500 horses. These numbers are approximately the same as those of the previous season.

Of the cattle owned on farms at the beginning of the year, there were 2,218 milch cows, while at the end of the year the number had increased to 3,046. The number of cattle other than milch cows increased during the year by 311. It is estimated that the returns from the dairy cows during the year aggregated $30,000.

The number of hogs owned on farms was increased very little during the year. However, the higher prices secured, together with

improved methods of care and feeding, resulted in a marked increase in the cash return from the hogs sold. It is estimated that the total receipts from the shipment of hogs from the project farms during the year were $460,000, as compared with $230,000 for the previous year.

The number of sheep decreased materially, but the number of fowls increased by more than 12,000.

TABLE III.—*Live stock on the North Platte Reclamation Project in 1916.*

Item.	Inventory, January 1.			Inventory, December 31.			Increased total value.
	Number.	Average value.	Total value.	Number.	Average value.	Total value.	
Horses	5,508	$90.00	$495,720.00	6,398	$100.00	$639,800.00	$123,880.00
Mules	202	100.00	20,200.00				
Cattle	6,941	50.00	347,050.00	8,080	55.00	444,400.00	97,350.00
Sheep	2,254	4.00	9,016.00	1,401	5.00	7,005.00	2,011.00
Hogs	24,926	8.00	199,424.00	25,123	10.00	251,230.00	51,806.00
Fowls	46,971	.40	18,788.40	59,249	.50	29,624.50	10,836.10
Bees, hives	630	3.00	1,890.00	764	3.50	2,674.00	784.00
Total			1,092,088.40			1,349,610.50	282,645.10

EXPERIMENTS WITH GRASS PASTURES.

The grass-pasture experiments were started in 1913, and detailed accounts of them have been given in previous reports. This work was continued in 1916 and the cows of the dairy herd were again used for pasturing, in order to determine the carrying capacity of the plats. The total area devoted to pasture was 3.88 acres, of which 0.34 of an acre was sweet clover. The 3.54 acres was divided into seven fields or plats. This permitted frequent changing of the cows from pasture to pasture and also facilitated irrigation when required. A mistake was made when the pastures were first seeded, in that the poorest areas on the farm were used for this purpose, and as a result the carrying capacity is very low. The manuring of these pastures may increase the grass yields, to some extent at least.

Four dairy cows in milk were used in these pastures, never more than two cows being kept in each field at any one time. In 1915 the cows received some hay in connection with the pasturing, but this was found to be an unsatisfactory manner of determining the actual carrying capacity of the pastures. In 1916, when the pasture became too short the animals were removed until the grass had again made some growth. During the pasturing season, which included the months of May, June, July, and August, the 3.54 acres of grass pasture furnished a total of 192 pasture days for one cow, or 54 pasture days per acre. The 0.34 of an acre of sweet clover furnished a total of 88 pasture days for one cow, or 260 pasture days per acre.

Although the sweet clover gave much the best returns, it must be borne in mind that this crop is a biennial and requires reseeding every two years. Close pasturing must also be avoided the first year, or killing out may result. While sweet clover appears to be less likely to cause bloat than alfalfa, it is true that there is some danger from bloat when sweet clover is pastured. Animals to pasture on sweet clover should be turned in early in the spring before it gets too much of a start or late in the season after it has attained a growth of about 18 inches or more but before the plants become woody in texture.

In order to provide for securing more definite information with reference to the behavior of these grasses when grown separately and in various mixtures, a new series of plats was started in field F in 1915. These plats were laid out 8 feet square, with 1-foot alleys between them, and were sown in duplicate on May 31 to the following: Wheat-grass, smooth brome-grass, orchard grass, timothy, golden oat-grass, Italian rye-grass, perennial rye-grass, tall oat-grass, meadow fescue, sheep's fescue, tall fescue, redtop, bluegrass, red clover, white clover, alsike clover, sweet clover, and alfalfa. In addition to these duplicate plats of the separate species, a number of combinations of grass mixtures were also sown, but these plats were not duplicated. The grasses were sown without a nurse crop, but the plats were covered with a light sprinkling of straw, to retain the moisture after the seeds germinated. A good stand was secured on all plats, and the growth of the first year was very satisfactory.

Most of the grasses came through the winter of 1915-16 in good condition with practically no winterkilling. The Italian rye-grass and the perennial rye-grass are the only ones that showed decided winterkilling. The sweet clover, however, was killed out completely by close cutting. In 1915 the alfalfa suffered to some extent from close cutting, but this did not seem to affect it the second year.

During the growing season six irrigations were applied. None of these were heavy, but they kept the grasses in good condition throughout the season.

The results obtained during the season are given in Table IV. The first date of cutting is given in order to show the approximate time when the grasses may be utilized for pasture. The green and dry weights of the yield per plat are given, as well as the computed acre yield, which may give a better basis for comparison.

Table IV indicates the adaptability of pasture grasses to the conditions of western Nebraska and the amount of pasture that may reasonably be expected from those grasses and may be used as a basis for making up pasture mixtures.

TABLE IV.—*Yields of forage from plats of grasses, per plat and per acre, at the Scottsbluff Experiment Farm in 1916.*

Grass.	Date of first cutting.	Number of cuttings.	Average yield (pounds).			
			Per plat.		Per acre.	
			Green.	Dry.	Green.	Dry.
Wheat-grass	Apr. 26	6	14.4	5.0	9,349	3,246
Smooth brome-grass (*Bromus inermis*)	do	6	18.6	4.5	12,076	2,921
Orchard grass	May 15	5	13.1	1.8	8,505	1,168
Timothy	do	5	5.5	1.2	3,571	879
Golden oat-grass	Apr. 26	5	5.6	1.7	3,636	1,103
Italian rye-grass [1]	June 25	3	12.0	3.1	7,791	2,012
Perennial rye-grass [1]	June 10	4	6.0	1.6	3,895	1,038
Tall oat-grass	Apr. 26	6	17.7	4.3	11,492	2,791
Meadow fescue	do	6	17.5	4.4	11,362	2,856
Sheep's fescue	do	6	4.7	1.1	3,051	714
Tall fescue	do	6	16.3	4.2	10,583	2,727
Redtop	do	6	12.6	3.1	8,181	2,012
Bluegrass	do	6	8.8	2.6	5,714	1,688
Red clover	do	6	36.6	7.5	23,764	4,869
White clover	May 15	5	28.6	4.2	18,570	2,727
Alfalfa	Apr. 26	6	64.9	13.0	42,139	8,440
Sweet clover [1]	do	4	24.6	3.4	15,972	2,207
Alsike clover	do	6	49.3	9.7	32,010	6,298

[1] The greater part of the yield of these plats was pigeon grass. This came up after the grasses died out during the winter.

Table V gives the yields of the grasses grown in various mixtures. In some instances the mixture produced larger yields than the average of the same grasses grown separately. A good grass mixture should contain grasses that will furnish both early and late pasture and the maximum amount of feed throughout the season.

TABLE V.—*Yields of grasses from plats on which the crops were grown separately, compared with the same kinds grown in mixtures, at the Scottsbluff Experiment Farm in 1916.*

Mixture.	Yield per acre of air-dry material.	
	Mixture.	Average of the same kinds grown separately.
	Pounds.	*Pounds.*
Meadow fescue, wheat-grass, and perennial rye-grass	2,662	2,358
Smooth brome-grass (*Bromus inermis*) and redtop	4,052	2,466
Bluegrass, Italian rye-grass, and orchard grass	2,662	1,623
Sheep's fescue and redtop	2,467	1,363
Golden oat-grass and white clover	4,739	1,915
Sweet clover and sheep's fescue	2,662	1,460
Meadow fescue and orchard grass	2,921	2,012
Meadow fescue and white clover	5,129	2,727
Perennial rye-grass and tall oat-grass	973	1,914
Bluegrass, white clover, and alsike clover	5,973	5,356
Orchard grass and tall oat-grass	3,181	1,979

With but one exception, the grasses grown in the mixture produced more forage than the same grasses grown separately. It was found best to avoid the excessive use of clover in any one mixture, but all mixtures should contain some alsike or white clover.

ROTATION OF CROPS UNDER IRRIGATION.

The irrigated rotation work, which was started in 1912, occupies 80 quarter-acre plats. Nine of these plats are used for the continuous production of each of the crops included in the rotation. There are eleven 2-year, three 3-year, four 4-year, and four 6-year rotations. Three 2-year, one 3-year, and one 6-year rotation receive barnyard manure once during the period of the rotation at the rate of 12 tons per acre. The following are the crops used and the number of plats devoted to each: Alfalfa, 21 plats; beets, 14 plats; corn, 6 plats; flax, 2 plats; oats, 18 plats; potatoes, 13 plats; spring wheat, 5 plats; winter wheat, 1 plat. One plat of corn and one plat of alfalfa are harvested by hogs, and the yields of these two are not included in Table VI.

The persistent windstorms of the early spring and the severe hailstorm of July 12, 1916, did much damage. Winter wheat, spring-seeded alfalfa, and the first crop from the older alfalfa were practically destroyed. Flax, oats, and beets were so badly injured that it was necessary to reseed both flax plats, six plats of oats, and seven plats of beets, so that the yields from these crops were much below normal. The damage to the potatoes, corn, and the second, third, and fourth crops of alfalfa was less serious. The yield of spring wheat was seriously reduced by rust.

Table VI shows that there was a rather wide range between the highest and the lowest yields from plats devoted to the same crops. Each crop was seeded on the various plats at the same time with the same kind of seed and received the same cultural treatment after seeding.

TABLE VI.—*Yields per acre of three of the crops in the irrigated rotation experiments, Scottsbluff Experiment Farm, 1916.*

Number of plats.	Crop.	Maximum.	Average.	Minimum.
20	Alfalfa.....tons..	6.89	4.0	.....
5	Corn.....bushels..	56.00	46.0	39.3
13	Potatoes.....do....	318.80	232.2	128.0

Table VII brings out the most significant effects of the rotation on the yields of potatoes and corn. The plats are arranged in the order of their yield, from the highest to the lowest.

Table VII shows that in every instance the highest yields were obtained from plats which had grown alfalfa. For some reason barnyard manure did not show any marked influence on the yield of potatoes, as it has heretofore. The potatoes grown on the continuously cropped plat and in the 2-year rotation were very scabby; those grown in the 3-year rotation were less scabby, while those

grown in the 4-year and 6-year rotations were fairly free from scab. Corn following beets continues to show poor results, not so much in low yield as in slow, backward growth, resulting in "soft" corn.

The results of four years with potatoes following alfalfa are available and show an increase of 118 bushels per acre in favor of alfalfa land. An average of the results for five years shows that manure has increased the potato yield 46.8 bushels per acre. In previous years beets have responded to the influence of alfalfa and manure even more than potatoes. The results of two years with beets following oats or potatoes which followed alfalfa are available; these show an increase of 5.69 tons of beets per acre in favor of alfalfa land. An average of the results for four years shows that manure has increased the beet yield 4.24 tons per acre.

TABLE VII.—*Crop yields per acre and crops of preceding years in the rotation experiments at the Scottsbluff Experiment Farm in 1916.*

[Oats-M indicates manure at the rate of 12 tons per acre applied to the oat stubble and plowed under for the following crop; potatoes-M indicates manure applied at the same rate after the potatoes were harvested; oats-R indicates that rye was seeded in the oat stubble, to be plowed under as green manure the following spring.]

Potatoes.			Corn.		
Rotation No.	Crops in preceding years.	Yield per acre.	Rotation No.	Crops in preceding years.	Yield per acre.
		Bush.			*Bush.*
60	Beets, alfalfa, alfalfa, alfalfa	318.8	62	Beets, alfalfa, alfalfa, alfalfa	56.0
44	Potatoes, oats, alfalfa, alfalfa	307.6	16	Corn, oats, corn, oats	50.6
61	Beets-M, alfalfa, alfalfa, alfalfa	305.6	6	Corn, corn, corn, corn	43.6
40	Potatoes, beets, alfalfa, alfalfa	285.5	26	Corn, potatoes, corn, potatoes	40.7
27	Potatoes, oats-R, potatoes, oats-R	245.5	32	Beets, corn, oats, beets	39.3
31	Beets, potatoes, oats-M, beets	243.9			
26	Potatoes, corn, potatoes, corn	226.6			
30	Beets, potatoes, oats, beets	226.2			
24	Potatoes, oats, potatoes, oats	217.5			
25	Potatoes, oats-M, potatoes, oats-M	216.3			
21	Potatoes-M, beets, potatoes-M, beets	154.7			
20	Potatoes, beets, potatoes, beets	142.5			
4	Potatoes, potatoes, potatoes, potatoes	128.6			

Another fact of importance demonstrated in the rotation experiment is the possibility of seeding alfalfa in the fall after the crop of small grain has been removed. Heretofore it has been thought necessary either to sow alfalfa with the small grain as a nurse crop or to postpone seeding until the following spring. Neither method produces very much forage the first season. The practice of seeding in the stubble after the small grain has so far resulted in good stands and in giving nearly a full crop the following year, as is shown in Table VIII, which gives the maximum, mean, and minimum yields from the last three crops for 1916 from plats spring seeded in 1916, and the plats seeded in the late summer of 1915 compared with crops of old alfalfa, showing also the 4-year average yield from these different seedings. The first crop of 1916 was badly injured by hail

and is therefore omitted from the table. During the course of this experiment, a period of five years, the yield the first season from spring seeding has been very low as compared with fall seeding the first season or old alfalfa, but it has not been a total failure except in 1914.

TABLE VIII.—*Yields per acre of alfalfa in 1916 from plats spring seeded in 1916 and those fall seeded in 1915 compared with crops of old alfalfa and with 4-year averages of the different seedings, at the Scottsbluff Experiment Farm.*

Number of plats.	Class.	Maximum.	Mean.	Minimum.	Four-year average.
		Tons.	*Tons.*	*Tons.*	*Tons.*
5	1916, spring seeded				1.46
3	1915, fall seeded	3.54	3.49	3.45	4.32
12	Second and third year crops	5.76	5.09	4.62	5.49

THE USE OF HOGS IN DISPOSING OF CROPS.

Since the beginning of the rotation experiments just described, two plats have been harvested by hogs. One of these plats has been in alfalfa and the other in corn. The hogs were kept on the alfalfa from early spring until fall, being fed a supplementary ration of corn. About the middle of September they were turned upon the corn plat to harvest the crop.

As fall-farrowed pigs are ready for market about the middle of the summer when fed a liberal ration of grain and as spring-farrowed pigs are not large enough to begin pasturing in the early spring, it was necessary to use two lots of hogs during the pasturing season. The first lot was composed of hogs farrowed the previous autumn. During the past season these were kept on pasture from April 29 to June 28. The second lot was composed of hogs farrowed in the spring. These young pigs were placed on the pasture on June 29. A few were removed about the last of August to prevent overpasturing the plat, and the remainder were kept on the alfalfa until September 19. During the entire pasturing period the hogs were fed a supplementary ration of corn at the rate of 2 pounds of corn for each 100 pounds of live weight. They received in addition certain condiments, such as salt, coal, and phosphate rock.

The results with both lots, including the total for 1916 and the average for the four seasons of the alfalfa pasturing, computed to an acre basis, are given in Table IX.

If values of 7 cents a pound are assigned to the gains made and $1.07 per hundredweight, or 60 cents a bushel, to the corn consumed, the net return from the first lot is $64.64 and from the second lot $82.32, or $146.96 for the season of 1916. If the first lot is charged $7 per acre for alfalfa pasture and the second lot $8, in

addition to a charge of $1.07 per hundredweight for the corn consumed, the cost of feed to produce 100 pounds of gain is $3 for lot 1 and $2.80 for lot 2, or an average of $2.91 for both lots. The average feed cost per 100 pounds of gain for four years is $3.04. Alfalfa plats similar to the pastured plat were cut for hay and yielded at the rate of 5.78 tons per acre. On the basis of this yield the hogs paid the equivalent of $25.41 a ton for the 1916 crop of alfalfa hay. The average yield of hay from similar plats during the past four years has been 5.58 tons per acre. At this rate the hogs have paid the equivalent of $26.05 a ton for hay.

TABLE IX.—*Results per acre secured by pasturing hogs on alfalfa with a 2 per cent corn ration for 1916 compared with the average results of 1913 to 1916, inclusive, at the Scottsbluff Experiment Farm.*

Items of comparison.	Season of 1916.			Four-year average.
	Lot 1.	Lot 2.	Both lots.	
Initial number of hogs	12	20	.....	.....
Total initial weight ..... pounds..	2,004	1,784	.....	.....
Total gain made ..... do....	1,440	1,788	3,228	3,298
Corn fed ..... do....	3,380	4,004	7,384	7,991
Net return for pasture	$64.64	$82.32	$146.96	$145.36
Corn fed per pound of gain ..... pounds..	2.35	2.24	2.28	2.41
Cost per 100 pounds of gain (pasture at $15; corn at 60 cents)....	$3.00	$2.80	$2.91	$3.04

The hogs made 210 pounds of gain from the quarter-acre corn plat, which is at the rate of 840 pounds per acre of corn. This return for 1916 may be compared to the average return from the same experiment during the five years, 1912 to 1916, which is 748 pounds of pork from an acre of corn. This average includes the low return of 212 pounds in 1915, when the corn crop was very poor. The corn crop hogged in 1912 was on land following oats, but since then the corn has followed alfalfa. The yield of the corn on the hogged plat was carefully estimated each year. If these estimates are correct, the plats yielded when computed to the basis of 1 acre 56.1 bushels in 1912, 82.6 bushels in 1913, 81.9 bushels in 1914, and 66.9 bushels in 1916. On this basis, if a value of 7 cents a pound is assigned to the gains made, the returns per acre equal $42.96 for 1912, $70.48 for 1913, $72.36 for 1914, and $58.80 for 1916, or a return per bushel of 77, 86, 90, and 88 cents, respectively, for the corn crop.

GRAIN VARIETY TESTS.

SMALL GRAINS.

The variety test of grain in 1916 included spring wheat, oats, and barley. The hailstorm of June 12 did serious damage to all the small grains. This was especially the case with the early varieties that were jointing or heading at the time of the hail.

SPRING WHEAT.

The 11 wheat varieties were sown in duplicate plats of 0.2357 acre each, on field I, south end of Series I. This land had been in alfalfa for three years and was in potatoes in 1915. No new varieties were added this year, but all of the varieties grown in 1915 were again seeded. The yields obtained in 1916, together with the average yield for the term of years that these were grown, are given in Table X.

TABLE X.—*Yields per acre of varieties of spring wheat at the Scottsbluff Experiment Farm, 1911 to 1916, inclusive.*

Variety.	1916		Average annual yield.	
	Grain.	Straw.	Grain.	Straw.
Bread wheat:	*Bushels.*	*Pounds.*	*Bushels.*	*Pounds.*
Ghirka.....six years..	12.5	1,367	33.3	2,640
Lambahara.....do....	12.9	1,416	32.9	2,796
Galgalos.....do....	12.1	1,131	32.3	2,570
Rysting.....do....	11.7	1,060	31.0	2,348
Defiance.....do....	9.0	1,272	30.0	2,600
Dicklow.....three years..	4.7	1,131	18.7	3,649
Marquis.....two years..	13.3	494	23.3	3,832
Durum wheat:				
Arnautka.....do....	23.5	989	33.7	4,918
Beloturka.....do....	14.5	989	32.8	4,110
Kubanka.....do....	17.2	895	30.3	4,489
Ble Dur.....do....	13.3	919	27.4	3,736

All of the grain was badly shrunken and unfit for market. The Dicklow wheat was again badly affected by rust. For the past three years this variety was the first to be attacked by rust and appeared to suffer more than any other variety on account of it.

OATS.

The oat varieties were grown on the south end of Series II, field I. The land was in alfalfa for three years and in potatoes in 1915. Although 17 varieties were planted, two varieties were not harvested, having suffered from hail to such an extent that they did not recover. As in previous years, the early varieties appeared to withstand the adverse climatic conditions much better than the late varieties, which usually grow more luxuriantly and suffer more severely from hail. These varieties were seeded on duplicate 0.2357-acre plats, with the exception of the White Russian, White Tartarian, Black Anthony, and Rustproof, which were seeded in single plats. Table XI shows the yields per acre for 1916 and the average yield of the varieties for the number of years they were grown.

The Rustproof oat does not resist the rust any more than any of the other varieties. It has always been a low yielder, and on account of its reddish color is discriminated against on the market.

TABLE XI.—*Yields per acre of oat varieties in 1916 compared with the average yields for 1914 to 1916 at the Scottsbluff Experiment Farm.*

Variety.	1916		Average for three years.	Variety.	1916		Average for three years.
	Grain.	Straw.	Grain.		Grain.	Straw.	Grain.
	Bushels.	*Pounds.*	*Bushels.*		*Bushels.*	*Pounds.*	*Bushels.*
Wisconsin No. 1	85.0	4,289	60.2	White Plume	64.8	2,309	51.5
Kherson	82.8	3,005	70.1	Swedish Select	64.4	3,995	59.0
Golden Rain	82.4	3,299	64.1	Danish	61.8	3,464	57.3
Iowa No. 103	80.6	2,875	[a]68.6	Dakota No. 4	58.9	3,617	55.5
National	78.4	2,521	[a]60.7	Garton No. 5	46.7	2,309	40.6
Newmarket	77.0	3,181	64.9	Rustproof	35.7	2,533	39.3
Big Four	71.8	1,991	52.7	White Russian	33.5	2,710	[a]36.2
Canadian	65.5	2,474	78.2				

[a] Yields for 1915 and 1916 only.

BARLEY.

The barley varieties were grown on field I, north end of Series I and II. The yields were much lower than those of 1915. The land had been in alfalfa for three years. Series I was in corn in 1915 and Series II in potatoes. The barley was grown in duplicate plats of 0.2357 of an acre each. One set of plats was grown on each series. Barley is gradually increasing in favor as a feed, and, as shown above, the acreage on the project was more than twice as much in 1916 as in 1915. The yields on the experiment farm were much lower than they have been in previous years. The varieties grown were the same as in 1915 except that the Thomas barley was again tried and the Smyrna and Hooded varieties were dropped. Table XII gives the yields of the barley in 1916 and the average yield for the years that these varieties were grown.

TABLE XII.— *Yields per acre of barley varieties in 1916 compared with the average yield for the period of trials at the Scottsbluff Experiment Farm.*

Variety.	1916		1912 to 1916	
	Grain.	Straw.	Number of years.	Average.
	Bushels.	*Pounds.*		*Bushels.*
Two-rowed:				
Svanhals	67.8	2,640	3	69.8
Franconian	47.1	2,993	6	60.9
Hannchen	40.5	1,579	3	65.1
Moravian	37.0	2,357	3	76.9
Average	48.1	2,392	.....	68.2
Six-rowed:				
Caucasian	57.4	1,579	6	55.9
Barbary	49.3	2,781	6	72.0
Minnesota No. 105 (Manchuria)	47.9	1,343	6	50.9
Han River	47.4	2,144	3	74.1
Thomas	44.4	1,649	5	35.6
Mariout	40.7	1,814	6	55.4
Scotch	36.8	1,602	6	59.2
Coast (California Feed)	35.3	2,333	6	54.2
Average	44.9	1,906	.....	57.2

TIME OF SEEDING BARLEY.

It has always been a question with barley growers how early this grain should be seeded in the spring to obtain the maximum yield. In the spring of 1916 an experiment was inaugurated to determine the best time of planting. The first seeding was made on March 20 and the succeeding plantings at intervals of 10 days until May 12. Scotch barley was used for this work, being seeded in duplicate 0.2357-acre plats. Table XIII gives the time of seeding and the average yield of the plats.

TABLE XIII.—*Average yields of barley in a time-of-seeding experiment at the Scottsbluff Experiment Farm in 1916.*

Date of seeding.	Per acre.		Date of seeding.	Per acre.	
	Straw.	Grain.		Straw.	Grain.
	Pounds.	*Bushels.*		*Pounds.*	*Bushels.*
March 20	2,003	47.6	April 21	2,262	40.7
April 1	1,956	45.6	May 1	1,555	29.4
April 11	2,050	46.6	May 12	1,461	32.9

Regardless of the fact that the early-seeded plats suffered most severely from the hailstorms as the grain was heading at that time, the yield obtained from the early seeding this one year is decidedly in its favor. The climatic conditions prevailing during the early spring months were not especially favorable to this grain. The early-seeded barley did not seem to rust as badly as that of the late seeding. This may to some extent account for the increased yield.

CORN.

The growing season of corn being rather short in western Nebraska, an experiment was inaugurated to determine whether it would be possible to plant corn early in the season and thus avoid early frosts in the fall. In 1915 the first planting of corn was made on April 10. This was found to be too early; so in 1916 the first planting was made on April 20 and successive plantings every 10 days. Practically nothing was gained by this very early planting, as corn does not make good growth during cool weather. The corn was planted on field C, Series III, in duplicate tenth-acre plats. The land had been in alfalfa two years, sugar beets one year, small grain in 1915, and corn in 1916. Table XIV gives the results, including the time of planting and the yield. The results are in favor of the later planting, although it is not certain that May 20 will not prove rather too late for the best results.

TABLE XIV.—*Time of planting and yield of corn at the Scottsbluff Experiment Farm in 1916.*

Date of planting.	Date of coming up.	Yields.				
		Per tenth-acre plat.		Per acre.		Average per acre, both series.
		First series.	Second series.	First series.	Second series.	
		Pounds.	*Pounds.*	*Bushels.*	*Bushels.*	*Bushels.*
April 20	May 6	284	263	39.4	36.5	37.9
May 1	May 24	282	275	39.1	38.1	38.6
May 11	do	300	267	41.6	37.0	39.3
May 21	May 27	317	337	44.0	46.7	45.3

POTATOES.

The experiments with potatoes included a test of varieties,[1] a test of cultural and irrigation methods, and the use of various kinds of seed stock.

IRRIGATION AND TILLAGE.

Experiments in irrigation and tillage were conducted in single tenth-acre plats. The purpose of this work is to ascertain whether some variation of the usual method of irrigating the crop influences the total yield of marketable tubers. The experiments include five different methods of irrigation, as follows:

A. Irrigation confined to alternate furrows, the same furrow being irrigated each time.

B. Irrigation in every furrow as often as is necessary to keep the plants growing well.

C. Irrigation in alternate furrows, the furrows which are left dry at one irrigation being irrigated the next time.

D. Irrigation given in every furrow, as in B, but delayed each time until the soil is dry and the plants begin to suffer for water.

E. Irrigation given in every furrow and more frequently than in B, so that the plants always have an excess of water.

On two occasions these plats were entirely submerged from excessive rainfall, and at the time of the hailstorm, water and hail stood on them for about four days, vitiating the results to a great extent.

Table XV gives the yields obtained by each of the above methods. The results are not consistent with those secured in previous years.

TABLE XV.—*Yields per acre of potatoes resulting from different methods of irrigation at the Scottsbluff Experiment Farm, 1912 to 1916, inclusive.*

Irrigation method.	1912	1913	1914	1915	1916	Five-year average.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
A	187	155	154	99	259	170
B	184	140	212	147	305	197
C	199	185	174	105	304	193
D	187	161	177	100	259	176
E	184	175	240	105	276	196

[1] Conducted in cooperation with the Office of Horticultural Investigations of the Bureau of Plant Industry.

SEED SELECTION.

For three years experiments have been carried on in an effort to determine the best seed stock for use in planting. The seed stock used was of the Pearl and Eureka varieties, as follows: (1) Immature seed, secured by planting potatoes about the end of June (potatoes planted at that time will not mature by harvest); (2) bin selection, i. e., the seed stock was carefully selected from the bins in the cellar, all tubers being smooth and of typical shape (cut to two and three eyes); (3) culls, selected to include all smooth typical tubers from among those that went through the 1¾-inch screen (planted without cutting); (4) whole tubers, selected from the same stock in the bin, nothing below a 3-ounce tuber being taken (planted without cutting); (5) field selection, chosen by following the digger and watching for the best hills as they came over the screen (cut to two and three eyes); (6) field run, being tubers picked from the field without any selection (cut whenever they were of large size).

It is practically impossible to make a satisfactory selection of hills by following the digger. Unless the tubers adhere to the vines, such selection must be largely guesswork and can not be relied upon.

Table XVI gives the summarized results for the three years covered by the experiments. On account of the late hail in 1915 it was impossible to get good immature seed stock of the Pearl. Most of the seed averaged about 1 inch in diameter. The Eureka immature seed stock was below the average, but was much better than that of the Pearl variety.

TABLE XVI.—*Yields per acre of potatoes as a result of using various kinds of seed stock at the Scottsbluff Experiment Farm in 1914, 1915, and 1916.*

Variety and class of seed.	1914	1195	1916	Three-year average.	Variety and class of seed.	1914	1915	1916	Three-year average.
Pearl:	*Bush.*	*Bush.*	*Bush.*	*Bush.*	Eureka:	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Immature seed..	207.6	327.4	206.6	247.2	Immature seed..	353.3	257.0	332.8	314.4
Bin selection....	154.3	251.6	264.5	223.5	Whole tubers....	329.0	241.6	270.1	292.9
Culls.....	183.3	199.1	217.1	199.8	Culls.....	239.0	200.4	224.7	251.4
Whole tubers....	131.6	205.3	243.8	193.8	Bin selection....	305.0	179.9	262.4	249.1
Field selection...	200.5	123.2	250.8	191.5	Field run.....	320.8	160.8	220.3	234.0
Field run.....	178.6	127.0	96.6	134.0	Field selection...	336.6	141.1	144.4	207.4

EXPERIMENTS WITH ALFALFA.

The experimental work with alfalfa consisted of different cultural methods applied to the crop and the trial of several strains of alfalfa. Although this work was started in 1915, the data for the first year were rejected on account of the hail, which damaged the crop very unevenly.

CULTURAL TREATMENT.

The work was conducted on triplicate tenth-acre plats. The stand on these plats is as even as can be secured; no single plat would

be benefited by having a heavier stand. Three methods of procedure were used, as follows:

(1) Spring toothed; harrowed with a spring-tooth harrow, run so shallow that it did not tear out or dig up any of the plants. This operation destroyed much of the "poverty" grass that infests the first cutting of alfalfa.

(2) Disked. The disk harrow was used, setting the disks at a very slight angle to avoid destroying too many of the plants.

(3) Manured. The manure was applied with a manure spreader in the early spring at the rate of 10 tons to the acre.

The average results of these plats are summarized in Table XVII.

TABLE XVII.—*Yields of alfalfa hay resulting from the application of different cultural methods at the Scottsbluff Experiment Farm in 1916.*

Cultural method.	Average yield.			
	Per cutting per plat.			Per acre.
	July 5.	Aug. 9.	Sept. 14.	
	Pounds.	*Pounds.*	*Pounds.*	*Tons.*
Manured	2,230	898	746	6.46
Spring-toothed	1,408	884	746	4.49
Disked	857	848	672	3.96
Check	1,470	872	658	5.00

VARIETY TEST OF ALFALFA.

The seed for planting for the variety test of alfalfa, with the exception of the native seed, was obtained from the Office of Forage-Crop Investigations of the Bureau of Plant Industry. The native seed was grown in eastern Wyoming. This work was conducted in duplicate tenth-acre plats. The results are summarized in Table XVIII in the average of the duplicate plats.

TABLE XVIII.— *Yields of hay of various strains of alfalfa at the Scottsbluff Experiment Farm in 1916.*

Variety.	Average yield per acre.	Variety.	Average yield per acre.
	Tons.		*Tons.*
Baltic	4.76	Canadian	4.50
Black Hills	4.67	Turkestan	3.92
Grimm	4.58	Native	3.49
Kansas	4.50		

As the Turkestan alfalfa does not recover and produce any late growth after the last cutting, it is rather undesirable for those who depend upon such growth for late fall pasture.

Approved:

WM. A. TAYLOR,
Chief of Bureau.

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